

**SHORT TERM RESULTS OF FUNCTIONAL OUTCOME OF PLATE OSTEOSYNTHESIS VS ANTEGRADE INTRA MEDULLARY INTERLOCKING NAILING IN THE TREATMENT OF THE FRACTURES OF SHAFT HUMERUS**

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**ABSTRACT**

**AIM:**The aim of our study is functional outcome of plate osteosynthesis VS Antegrade intramedullary interlocking nailing in the treatment of the fractures of shaft humerus **Methods:** A series of 24 patients with acute fractures of shaft of humerus were treated with ante grade interlocking nailing and plate osteosynthesis during September 2013 to March 2015. All the patients were followed up, results were analyzed. **Results:** 23 fractures united with average time of 17 weeks. Functional results were excellent in 22(91%), moderate in 1(4.5%) and poor in 1(4.5%).Complications met with were shoulder stiffness, infection, non-union and delayed union. **Conclusion:** Closed antegrade interlocking nailing offers a safe and reliable method of fixing fractures of humeral shaft, with early fracture consolidation and higher union rates. It provides early rehabilitation and reduces the hospital stay.

**Keywords:** Short term results, Osteosynthesis, Shaft humerus

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**1.INTRODUCTION**

To study the results of functional outcome of plate osteosynthesis VS Antegrade intra medullary interlocking nailing in the treatment of the fractures of shaft humerus

Simple humeral shaft fractures can be treated nonoperatively, with good results in most cases 1, 2, 3, 4, 5. Although complications are infrequent, nonoperative treatment requires a long period of immobilization, which carries a risk of prolonged shoulder joint stiffness and may be inconvenient for the patient 6, 7. Furthermore, nonunion after conservative treatment of these fractures does occur in up to 10% of the cases and treatment of this condition can be very difficult 8, 9, 10. There is growing interest in treating even simple humeral shaft fractures by dynamic

compression (DC) plate fixation or intramedullary (IM) nailing in order to avoid these problems and to allow earlier mobilization and rapid return to work 11,12,13.

Indications for surgical intervention include open fractures, vascular injury, progressive radial nerve palsy, polytrauma patients, bilateral fractures, concomitant fractures in the ipsilateral upper extremity, associated burns, obese patients, certain transverse, segmental, and spiral fractures without bony contact due to potential soft tissue interposition, pathological fractures, and inability to achieve or maintain satisfactory reduction.14,15,16,17,18,19–22. Displaced fractures almost always require surgical intervention to obtain a favourable outcome.23,24,25,26,27.

The operative line involves open reduction of fracture and internal fixation with plate osteosynthesis or closed reduction and intramedullary implant or external fixation.

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The humeral locking nail was first proposed by Seidel (1985). The entrance is at the proximal end of the humerus and penetrates the rotator cuff. With this nail the proximal fragments can be stabilized with locking screws guided through the nail. The rotator cuff is protected because the nail is safely fixed with the locking screws below the level of the rotator cuff.

Advantages of closed intramedullary nailing are well established.

- (1) It does not disturb the fracture hematoma and aides in natural healing of fractures.
- (2) Avoids dissection at fracture site thereby reducing contamination of fracture site
- (3) The periosteal blood supply is preserved.
- (4)

Although closed intramedullary nailing with interlocking is a good treatment for fracture shaft humerus, it has some disadvantages like shoulder impingement, painful shoulder movements in antegrade nailing and that of elbow in retrograde nailing and potential radial nerve palsy theoretically humeral fracture fixation with locked intramedullary nailing offers an appealing solution, as it is less invasive, has a superior biomechanical behavior, especially in osteopenic bone, and provides autograft material through reaming.6,14.

Plate osteosynthesis has given high rates of fracture union with anatomical reduction and good compression across fracture site, with no damage to the rotator cuff and the elbow joint, but has the disadvantage of excessive periosteal stripping, extensive incision, increased chances of infection or nerve damage, less secured fracture of osteopenic bone. Further there is a stress shielding of bone by the plate and reduced strength of union due to primary bone healing compared to the callus healing seen in biological fixation with intramedullary nailing.

Hence a comprehensive study is conducted to find the ideal mode of surgical management of different types of closed fractures of mid shaft humerus and their functional outcomes.

## 2.MATERIALS AND METHODS:

This retrospective and prospective comparative study of management of humeral shaft fractures by humeral interlocking nailing and plate osteosynthesis was carried out at Rajah Muthiah medical collage from September 2013 to March 2015.

### Selection Criteria:

1. Diaphyseal fractures of humerus (Transverse, oblique, comminuted)
2. Segmental fractures
3. Compound fractures (Gustilo & Anderson Grade I & II)
4. Fractures shaft humerus associated with radial nerve palsy.
5. Adult patients over 16 years of age

6. Patient with polytrauma where early mobilization is needed

### Exclusion criteria:

1. Patients with previous osteomyelitis of shaft of humerus
2. Patients with recent infections
3. Immunosuppressive therapy
4. Proximal fractures within 2 cm of surgical neck and those within 5 cm of junction of diaphyses and metaphyses on both AP and lateral radiographs.
5. Compound grade-III fractures.
6. Age group < 15 yrs

TYPE OF METHOD OF FIXATION	INTRAMEDULLARY NAILING	PLATIN G	TOTAL
A1	6	1	7
A2	2	3	5
A3	1	2	3
B1	1	1	2
B2	1	2	3
B3	-	-	-
C1	1	2	3
C2	-	1	1
	12	12	24

Among 24 patients, there were 10 patients with plate osteosynthesis operated earlier and the data collected from MRD. Of the remaining 14 patients, two were with radial nerve palsy for whom ORIF with plate and screws was done. Rest of the 12 patients underwent closed interlocking intramedullary nailing. There was no incidence of opening the fracture site in any of the patients with nailing.

### FRACTURE PATTERN & MODALITIES OF TREATMENT

Primary treatment was given in the form of splintage, antiseptic dressing, antibiotics, analgesics, anti-inflammatory drugs and intravenous fluids. Routine investigations were done and initial radiographs taken in anteroposterior and lateral directions.

Fractures were classified according to AO fracture classification,

Total 24 patients

15 fractures were type A (7 type A1, 5 type A2, and 3 type A3),

5 fractures were type B (2 type B1 and 3 type B2), and

4 fractures were type C (3 type C1, 1 type C2)

Fractures to which plate fixation done were classified according to AO fracture classification,

6 fractures were type A (1 type A1, 3 type A2, and 2 type A3),

3 fractures were type B (1 type B1 and 2 type B2), and

3 fractures were type C (2 type C1, 1 type C2)

Fractures to which nailing done were classified according to AO fracture classification,

9 fractures were type A (6 type A1, 2 type A2, and 1 type A3),

2 fractures were type B (1 type B1 and 1 type B2), and

1 fractures were type C (1 type C1)

5 fractures were located in the proximal third of the humeral shaft, 16 in the middle third, and 3 in the distal third.

12 cases were treated with closed antegrade nailing of humerus (with C arm).

12 cases were treated with open reduction Plate osteosynthesis.

In closed antegrade nailing patients were placed in supine position and upper portion of table was elevated about 45-50 degrees. A 2cm incision was given from anterolateral corner of the acromion to lateral aspect of arm. After superficial dissection, deltoid muscle was split in line of skin incision. Supraspinatus tendon was identified and is split 1-2cm inline of its fibres. Entry portal was made just lateral to the articular margin and just medial to greater tuberosity. Reaming was done in all cases up to 1mm more than the diameter of nail to be used. Proper size nail was inserted after achieving reduction under C-Arm. Distal locking was done first by free hand technique using C-Arm from anterior to posterior. Then after checking the reduction the proximal locking was done using proximal jig from lateral to medial. The wound was closed in layers after achieving complete haemostasis.

Post operatively limb elevation and active finger movements were advised as soon as pain subsides. Postoperative regimen included pendulum exercises from the first postoperative day and active shoulder movement as soon as pain allowed. Parenteral antibiotics were given for two days, followed by oral antibiotics depending upon the wound condition. Active shoulder and elbow exercises except external rotation and extreme abduction were started as soon as pain subsided. Sutures were removed from 11th-14th day

Plate osteosynthesis was done through anterolateral approach of Henry and posterior approach for patients with radial nerve palsy. Fracture site was exposed. Fracture was reduced and fixed with either narrow or broad 4.5 mm dynamic compression plate (DCP) with minimal of 7 cortices on either side. Depending on fracture stability, external splint in form of 'U' slab was used. Post operatively a check x-ray was taken and patient was called for follow up visit at OPD level.

All patients were followed up at monthly intervals for 6 months. During this period patients were motivated for physiotherapy and gradual normal use of the affected limb. Patients were assessed clinically and radiologically. Constant scoring system was used to assess the function of the shoulder and elbow.

### 3.RESULTS:

Total of 24 patients with humeral shaft fractures treated operatively were included for the study. The retrospective cases were called for assessment.

The age of patients ranged from 19 to 57 years.

Of the total 24 patients, 10 were female and 14 were males.

20 fractures were closed and 4 were open, Gustilo grade 1.

2 patients had associated radial nerve palsy at the time of injury.

Among 24 fractures 16 patients had fractures because of road side accident (66.6%), 3 patients had fall (12.5%) and 5 patients had direct trauma (20.8%) by assault.

Out of the total 24 patients, youngest patient was 19 years old and eldest was 55 years. Majority of patients were between 27 to 45 yrs age group.

Of the total 24 patients, 3 cases were of fracture of proximal third, 18 cases were of fracture of middle third (52.6 %) and 3 patients were of lower third (31 %).

Among 24 patients 79.9 % cases were of right side fractures and 20.1 % were of left side fractures.

The commonest type of fracture in our series as per AO classification is type A (62.5%). 20.8% of fractures are of type B and 16.6% cases type C fracture.

In majority of cases, the fracture was fixed within 10 days (92.2 %). The earliest was within 1 day and the longest was after 7 days of trauma. Average duration was around 3 days

The postoperative hospital stay was 2 to 8 days for intra medullary nailing, and 5 to 12 days for patients with plating.

None of the patients required a blood transfusion following humeral nailing, where as all the 12 patients with plating needed unit of blood transfusion.

X-ray exposure time during the procedure was 15 - 30 s in cases of nailing where as intra op x- ray exposure was not needed for plating.

Length of the scar: plating 15-20 cm, nailing- 3-5cm

Average blood loss: plating 3- 5 mop pad; Nailing - < 1 mop pad

Average time taken for surgery: nailing - 1hr 15 min, plating - 1hr 40 min

Post op infection: plating 2 , nailing 0.

Nailing:

Most of the patient had callus by 8 weeks (83.4 %) with only 16.6 % requiring more than 8 weeks.

Average time to union was 16 weeks (range, 11-22 weeks). Satisfactory function and pain relief as well as bony union were achieved

Almost all of the patients regained a good range of shoulder abduction of more than 90° (88 %). Only in 2 patients (12 %) abduction was less than 90 ° which was mainly due to impingement of nail on the acromion , No elbow problems were recorded in our series.

84.5 % of our patients had excellent external rotation. None of the patients in our series had external rotation less than 20°. Only in 2 patients (12 %), results were unsatisfactory. Rests of the 10 patients had either satisfactory or excellent results and were almost able to reach their pre-injury capacities

Plating:

Most of the patients had callus by 11-13 weeks (91.7 %) with only 8.3 % requiring more than 12 weeks.

Average time to union was 18.3 weeks (range, 16-28 weeks). Satisfactory function and pain relief as well as bony union were achieved

All patients had full range of shoulder and elbow movements

2 patients had pre operative radial nerve injury found to be neuropraxia and recovered by 14 and 20 weeks

#### 4.DISCUSSION:

When operative treatment is indicated, plate fixation probably still remains the primary choice of most surgeons, producing satisfactory functional results and union rate.<sup>15,23,30</sup> Comparative studies between plate fixation and intramedullary locked nailing have given contradictory results.<sup>5,17,22,24</sup> Plate fixation, however, has been associated with a higher iatrogenic nerve palsy rate, longer operating time, an increased need for blood transfusion, and possibly an increased infection rate.<sup>2,7,17,26</sup> The theoretical advantages of minimal soft tissue trauma, fracture hematoma preservation, and superior biomechanical properties, minimal blood loss, small scar, short duration of surgical procedure offered by closed interlocking nailing have recently made it increasingly popular among surgeons in the treatment of humeral shaft fractures. Additionally, intramedullary nails, being loadshearing

devices, allow for safe and early motion, thus being more suited for polytrauma patients who require early mobilization, In our series among 24 patients 12 nailing and 12 plating was done.

In 12 nailing patients, union was noted in 11 of the 12 acute fractures at an union rate of 92% (1 of delayed union)

In 12 plating union was noted in 11/ 12 and one non union for which resurgery was required and bone grafting with replating done.

This is in comparison to certain international studies in which union rates of 80-100% is noted. The rate of union is comparable to plate osteo-synthesis which in international standards is around 85-92%.

#### 5.CONCLUSION:

In this study series locked humeral nailing has offered a dependable solution for the treatment of humeral diaphyseal fractures, providing a satisfactory functional outcome and a high union rate, allowing at the same time early use of the limb, which is of great importance, however Certain technical aspects, such as proper countersinking of the proximal end of the nail, avoidance of over distraction at the fracture site, and achievement of adequate fixation stability, must be given careful attention in an effort to reduce delayed union and non-union, Inter locking nailing of humerus is a safe and good method to treat acute humerus diaphysis fractures. The union rate is very good and comparable to that of plate osteosynthesis. The infection rate is very minimal, intraoperative blood loss is less. Chances of iatrogenic radial nerve injury is less and lesser malalignment of fracture fragments. It is also rotationally stable and cosmetically appealing. Shoulder stiffness can be prevented with early fixation and proper rehabilitation protocol.

The present study was aimed to evaluate and compare the functional outcome of plating versus interlocking nailing in the treatment of the fracture of the shaft of the humerus. From the above observation it is clear that interlocking nailing has following advantages over plating.

1. Higher union rate.
2. Interlocking nailing being a load sharing implant is a more physiological fixation than plating and hence early return to pre-fracture state is possible.
3. Lower rate of infection.
4. Lower Radial nerve complication.
5. minimal blood loss.
6. small scar.

Hence these make it an ideal method of fixation for following fractures.

- Closed comminuted fractures of shaft humerus.
- Compound fractures.
- Polytrauma patients where early mobilization is a goal.

However when used one has to take following precautions to prevent shoulder movement restriction by :

- Proper countersinking the nail at entry point.
- Irrigation of entry point site to remove all reamed bone debris.
- Careful dissection of rotator cuff to prevent its damage.
- Early mobilization and proper post-operative physiotherapy and rehabilitation.

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